

Claims

We Claim:

1. An apparatus for moving semiconductor wafers and related substrate  
objects, comprising:

5 a linear drive having linear motion along an x axis;  
a rotational drive extending from and mounted to said linear drive,  
for rotating about a theta axis;

10 a z axis linear drive extending from and mounted to said rotational  
drive having linear motion along a z axis, said z axis being offset from and  
substantially parallel to said theta axis; and

a radial drive extending from and mounted to said z axis linear  
drive, having an end effector.

2. The apparatus as recited in claim 1, wherein said end effector travels  
linearly along a radial axis.

15 3. The apparatus as recited in claim 2, wherein said radial axis rotates around  
said theta axis when said rotational drive rotates.

4. The apparatus as recited in claim 1, wherein said apparatus further includes an airflow unit mounted to said rotational drive.
5. The apparatus as recited in claim 4, wherein said airflow unit reduces the pressure within said z axis linear drive to prevent particles created by said z axis linear drive from contaminating a wafer supported by said end effector.
6. The apparatus as recited in claim 1, wherein said radial drive is removably mounted to said z axis linear drive.
7. The apparatus as recited in claim 6, wherein said radial drive includes at least one component selected from the group consisting of (i) an ID reader, (ii) a metrology tool, (iii) an aligner, (iv) a notch detector, (v) an edge detector, (vi) a wafer marking tool, (vii) a processing module, (viii) a wafer viewing, and (ix) environmental control.
8. The apparatus as recited in claim 1, wherein a fan/filter unit is mounted to said radial drive, said fan/filter unit is adapted to prevent particles created by said radial drive from contaminating a wafer supported by said end effector.

9. The apparatus as recited in claim 1, wherein a wafer supported by said end effector traces out a circular area when said rotational drives rotates the apparatus.
10. The apparatus as recited in claim 9, wherein said z axis linear drive remains within the circular area.
- 5       11. A wafer engine for transporting semiconductor wafers and related substrate objects, comprising:
- a linear drive having linear motion along an x axis;
- a rotational drive extending from and mounted to said linear drive, for rotating about a theta axis;
- 10       a z axis linear drive located above and mounted to said rotational drive, having linear motion along a z axis, said z-axis being offset and substantially parallel to said theta axis;
- a radial drive extending from and removably mounted to said z axis linear drive, including at least one end effector having linear motion along a radial axis; and
- 15       said theta axis extends through said radial drive such that said theta axis and the center of said radial drive are offset.

12. The wafer engine as recited in claim 11, wherein said z axis linear drive rotates through a substantially similar clearance diameter as the wafer when said rotational drive rotates about said theta axis.

13. The wafer engine as recited in claim 11, wherein said radial drive includes  
5 at least one component selected from the group consisting of (i) an ID reader, (ii) a metrology tool, (iii) an aligner, (iv) a notch detector, (v) an edge detector, and (vi) a wafer marking tool.

14. A system for handling semiconductor wafers and related substrate objects within a confined workspace, comprising:

10 a linear drive having a front end, a rear end, and an end effector, said linear drive for moving said end effector along a radial axis;  
means for moving said radial drive along an x and z direction, and for rotating said linear drive about a theta axis; and  
said front end of said linear drive rotates through a larger clearance  
15 diameter than said rear end of said linear drive.

15. A system for handling semiconductor wafers and related substrate objects within a confined workspace, comprising:

means for providing linear motion;

a housing enclosing said means for providing linear motion;  
an end effector mounted to said means for providing linear motion;  
means for moving said housing linearly in a z direction, and for  
rotating said housing about a theta axis; and

5                   a device for reducing air pressure inside said housing such that  
articles created by said housing does not contaminate the wafer support by said  
ends effector.

16.       A mechanism for handling semiconductor wafers and related substrate  
objects, comprising:

10                  a linear drive;  
                        a housing enclosing said linear drive, said housing having an  
opening;

                        an end effector support structure mounted to said linear drive, said  
support structure extending through said opening in said housing;

15                  an end effector for handling semi-conductor wafers mounted to said  
end effector support structure;  
                        means for moving said housing along a Z direction and about a theta  
axis; and

20                  a rotary chuck mounted in said housing, for repositioning a wafer  
on said end effector.

17. A mechanism for handling semiconductor wafers and related substrate objects, comprising:

a first linear drive;

a second linear drive;

5 a housing enclosing said first and second linear drive, having a first linear opening and a second linear opening;

a first end effector, having a support structure mounted to and moved by said first linear drive, said support structure extending through said first linear opening;

10 a second end effector, having a support structure mounted to second linear drive, said support structure extending through said second linear opening;

means for moving said housing along a z axis;

means for rotating and housing about a theta axis; and

said first end effector including means to support and rotate a wafer

15 to a desired orientation.

18. A mechanism for handling semiconductor wafers and substrates, comprising:

an end effector;

a first drive mechanism for moving said end effector in a horizontal direction;

a carriage for supporting said horizontal drive mechanism;

a z column having a second drive mechanism for moving said carriage linearly in a vertical direction;

5 a rotational drive for rotating said z column around a vertical theta axis; and

said carriage being positioned to the side of said z column.

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